higher education & training

Department:
Higher Education and Training
REPUBLIC OF SOUTH AFRICA

T1380**(E)**(N17)T
NOVEMBER 2011

NATIONAL CERTIFICATE

MATHEMATICS N4

(16030164)

17 November (X-Paper)
09:00 – 12:00

Calculators may be used.

This question paper consists of 5 pages and a 1 page-formula sheet.

DEPARTMENT OF HIGHER EDUCATION AND TRAINING
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NATIONAL CERTIFICATE
MATHEMATICS N4
TIME: 3 HOURS
MARKS: 100

INSTRUCTIONS AND INFORMATION

1. Answer ALL the questions.
2. Answer ALL FIVE questions in full. Show ALL the calculations and intermediary steps. Simplify where possible.
3. ALL the graph work must be done in the ANSWER BOOK. Graph paper is NOT supplied. The values of intercepts with the system of axes and the turning point(s) must be shown on the graph.
4. ALL final answers must be accurately approximated to THREE decimal places.
5. Questions may be answered in any order, but subsections of questions must NOT be separated.
6. A formula sheet is attached to this question paper. You are NOT compelled to use the formulae and the list is NOT necessarily complete.

QUESTION 1

1.1 Make v the subject of the formula if:

$$i = I\left(e^{\frac{gv}{ct}} - 1\right)$$ (4)

1.2 Given:

$$2x - y + 3z = 1$$
$$3x + y - z - 2 = 0$$
$$x + 2y + 3z + 6 = 0$$

Solve for y by using Cramer's rule. (10)

1.3 The sum of two integers is 5. The difference between their squares is 45. Determine the numbers. (3)

1.4 Given:

$$4^{2x-1} = 5^{x+2}$$

Solve for x. (3)
[20]

QUESTION 2

2.1 Sketch the graph of $4y^2 = 36 - 4x^2$. (3)

2.2 2.2.1 Sketch the graph of $y = 2^{3x}$. (3)

2.2.2 Is the graph of $y = 2^{3x}$ continuous or discontinuous? (1)

2.3 Sketch the graph of $y = 2\sin x$; $0^0 \le x \le 360^0$. (3)

2.4 Solve for x if:

$$x^2 - 8x + 41 = 0$$ (5)

2.5 Simplify:

$$Z = \left(\frac{4\angle 30^0 \bullet 4\angle 40^0}{6\angle 20^0}\right)$$

Leave the answer in $a + jb$ form. (5)
[20]

PTO

QUESTION 3

3.1 Simplify:

$$\frac{1}{1+\tan^2 B} + \frac{1}{\cot^2 B+1} \quad (3)$$

3.2 Prove that:

$$\tan A \operatorname{cosec}^2 A.\cos^2 A = \cot A \quad (3)$$

3.3 Solve for A if:

$$6\cos^2 A+7\sin A-8=0 \; ; \; 0^0 \le A \le 180^0 \quad (5)$$

3.4 If $\cos A=\frac{8}{17}$ and $\sin B=\frac{12}{13}$; and A and B are acute angles, calculate the value of $\cos(A-B)$ without using a calculator. (5)

3.5 Solve for A if:

$$\cos(A+20^0)=\sin(A-20^0); \; 0^0 \le A \le 90^0 \quad (4)$$

[20]

QUESTION 4

4.1 Determine the following limit:

$$\lim_{x \to 3}\left(\frac{2x^3-54}{x-3}\right) \quad (4)$$

4.2 Differentiate by the use of product rule if:

$$y = \ell nx.\cot x \quad (4)$$

4.3 Differentiate the following with respect to x:

$$y=\frac{1}{2}e^{3x}+\frac{1}{2^{-3x}}+\frac{2}{x}-\cos 3x-3\pi \quad (5)$$

4.4 Given:

$$y = x^3 - x^2 - 6x$$

Calculate, using differentiation, the co-ordinates of the turning points and the point of inflection. (7)
[20]

QUESTION 5

5.1 5.1.1 Sketch the graph of $y = 2x^2 - 6x - 8$. Clearly indicate the area enclosed between the graph and the x-axis; $x = 0$ and $x = 4$. Show also the representative strip to be used to calculate the area indicated. (3)

5.1.2 Calculate, using integration, the area enclosed. (4)

5.2 Integrate:

$$\int \left(2x^3 - 0{,}6^{ax} + \frac{1}{e^{-2x}} + \frac{12}{x} + \sec x \tan x + 2p \right) dx$$ (7)

5.3 Simplify:

$$\int \sqrt{1 - \cos^2 x}\ dx$$ (3)

5.4 Determine:

$$\int_1^8 \frac{7}{x} dx.$$ (3)
[20]

TOTAL: 100

FORMULA SHEET

$a^x = b \Leftrightarrow \log a^x = \log b$

$\ell n\, x = \log_e x$

$(r\,|\,\underline{\theta})^n = r^n\,|\,\underline{n\theta} \quad a + bj = c + dj \Leftrightarrow a = c \text{ and } b = d$

$\sin(a \pm b) = \sin a \cos b \pm \sin b \cos a$
$\cos(a \pm b) = \cos a \cos b \mp \sin a \sin b$

$\sin^2 x + \cos^2 x = 1$
$1 + \cot^2 x = \operatorname{cosec}^2 x$
$1 + \tan^2 x = \sec^2 x$

$$\tan(a \pm b) = \frac{\tan a \pm \tan b}{1 \mp \tan a \tan b}$$

y	$\frac{dy}{dx}$
ax^n	nax^{n-1}
ka^x	$ka^x \ell na$
$k\ell nx$	$\frac{k}{x}$
$\sin x$	$\cos x$
$\cos x$	$-\sin x$
$\tan x$	$\sec^2 x$
$\cot x$	$-\operatorname{cosec}^2 x$
$\sec x$	$\sec x \tan x$
$\operatorname{cosec} x$	$-\operatorname{cosec} x \cot x$

$y = u(x) \cdot v(x)$

$$\Rightarrow \frac{dy}{dx} = u(x)v'(x) + u'(x)\,v(x)$$

$$y = \frac{u(x)}{v(x)}$$

$$\Rightarrow \frac{dy}{dx} = \frac{v(x)u'(x) - u(x)v'(x)}{[v(x)]^2}$$

$$\frac{dy}{dx} = \frac{dy}{du} \times \frac{du}{dx}$$

$$\int ax^n dx = \frac{ax^{n+1}}{n+1} + C$$

$$\int \frac{a}{x} dx = a\ell n\, x + c$$

$$\int ka^x dx = \frac{ka^x}{\ell na} + c$$

$$A_{ox} = \int_a^b y\, dx$$

$\int \sin x\, dx = -\cos x + c$

$\int \cos x\, dx = \sin x + c$

$\int \tan x\, dx = \ell n \sec x + c$

$\int \sec x\, dx = \ell n (\sec x + \tan x) + c$

$1 + \cot = \operatorname{cosec}$

$1 = \operatorname{cosec} - \cot$

$1 - \operatorname{cosec} = -\cot$

$-\cot =$
$-\operatorname{cosec} = -\cot - 1$